

Applicants: Zhou et al.
Serial No.: 10/722,340
Filing Date: November 25, 2003
Docket No.: VIM-002

Amendments to the Drawings:

One replacement sheet (2/9) containing drawing amendments is attached hereto. Please substitute the replacement sheet for figure 2 in place of the originally filed sheet. A “motion history buffer” has been added, as requested by the Examiner. Support for the “motion history buffer” is found in paragraphs [0046]-[0047] of the specification.

Attachment: 1 replacement sheet

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REMARKS

Reconsideration and allowance are respectfully requested.

Before entry of this amendment, claims 1-21 were pending. In the Office Action, claims 9-10 and 14-15 were objected to, and claims 1-8, 11-13 and 16-21 were rejected. In the present amendment, claims 1-4, 7, 9-10 and 13-14 are amended. After entry of the amendment, claims 1-21 are pending.

I. Claims 9-10 and 14-15

Claims 9-10 and 14-15 are objected to as being dependent upon rejected base claims, but would be allowable if rewritten in independent form. (Office Action, p. 5, lines 2-4.) Applicants amend claims 9-10 to include all of the limitations of the base claim 7 and any intervening claims. Applicants amend claims 14-15 to include all of the limitations of the base claim 13 and any intervening claims. Withdrawal of the objection to claims 9-10 and 14-15 is respectfully requested.

II. Claims 1-8, 11-13 and 16-21

Claims 1-8, 11-13 and 16-21 are rejected under 35 U.S.C. § 102(b) as being anticipated by Sezan et al. (USP 5,473,383) (Office Action, p. 3, lines 10-11).

A. Independent claim 1

Claim 1 recites, "(b) determining whether the block of pixels exhibits a motion characteristic; (c) wherein if the block of pixels is determined not to exhibit the motion characteristic in (b) then performing temporal interpolation to generate interline gap pixels for the block of pixels; (d) wherein if the block of pixels is determined to exhibit the motion characteristic in (b) then performing spatial interpolation to generate interline gap pixels for the block of pixels; and (e)

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repeating steps (a) through (d) for each of the blocks of pixels of the field"

(emphasis added).

Sezan does not form the basis for a valid rejection under § 102(b) because Sezan does not disclose all of the limitations of claim 1. Specifically, Sezan does not disclose any of (i) determining whether the a block of pixels exhibits a motion characteristic, (ii) performing temporal interpolation for the block if the block of pixels does not exhibit motion, (iii) performing spatial interpolation for the block if the block of pixels exhibits motion, or (iv) repeating the temporal interpolation and the spatial interpolation for each of the blocks of pixels of the field.

The Examiner states that "the claimed performing temporal interpolation to generate interline gap pixels for the block if the pixels of block is determined not to exhibit the motion characteristic and performing a spatial interpolation to generate the interline gap pixels for the block if the pixels of the block are determined to exhibit the motion is met by paragraphs 2, 4, 5 of column 5 and paragraph 5 of column 6 and the claimed repeating is met by column 5 line 53-column 9 line 26 (Figs. 4-7, abstract, column 1 lines 25-30, columns 5-9)" (Office Action, p. 3, lines 12-20). Applicants respectfully disagree. None of the cited passages or figures of Sezan discloses (i) determining a motion characteristic for a block of pixels, (ii) performing interpolation on a block of pixels, or (iii) repeating the motion detection and the interpolation for each block of pixels of the field.

(i) Sezan does not disclose block-based motion detection.

Sezan discloses performing motion detection on a pixel-by-pixel basis, as opposed to determining whether a block of pixels exhibits a motion characteristic. Sezan explains:

"Pursuant to the invention, merging or spatial interpolation is performed to estimate the values of the missing pixels, depending on the presence or absence of motion in the image at the locations of the missing pixels. Motion detection is performed for each one of the missing pixels x1, x2, . . . , x30, and the result is stored as a binary value in a storage space diagrammatically illustrated at M in FIG. 5. As will be described, a respective storage location of the storage

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space M will contain a "1" if image motion is detected for the missing pixel location x_i of interest and a "0" if there is no image motion for that missing pixel location." (Sezan, col. 5, lines 52-62) (emphasis added)

Motion detection in Sezan is determined for each missing pixel location x_i . (See Sezan, col. 9, lines 27-30.)

The pixel-based motion detection of Sezan uses information from only a few pixel values around the pixel for which motion is being estimated, for example, information from a three-by-three array. (See, e.g., Sezan, col. 6, lines 6-15.) Pixel-based motion detection such as that disclosed in Sezan is described in paragraph [0005] of the background section of the specification. Sezan does not, however, disclose determining whether a block of pixels exhibits a motion characteristic.

(ii) Sezan does not disclose interpolation for a block of pixels.

Claim 1 recites that if a block of pixels exhibits motion, then spatial interpolation is performed for the block of pixels. Claim 1 also recites that if a block of pixels does not exhibit motion, then temporal interpolation is performed for the block of pixels. Sezan does not disclose performing any type of interpolation as a result of a block of pixels being determined to exhibit or not to exhibit motion. Instead, no interpolation is performed in Sezan until motion or the absence of motion has been determined for all of the pixels of the field. Sezan explains:

"Once the motion decision storage space M is filled, step 502 is complete and the contents of motion decision storage space M are used to implement the merging/spatial interpolation process described above. Namely, if $m_i=0$ then $x_i=b_i$; otherwise a spatial interpolation of the odd field values is performed to determine x_i as set forth in Equations (1)-(5)." (Sezan, col. 8, lines 62-67) (emphasis added)

In addition, Sezan does not perform either temporal interpolation or spatial interpolation for a block of pixels. Instead, Sezan performs either merging

(temporal interpolation) or spatial interpolation on a pixel-by-pixel basis depending on whether each pixel exhibits motion. Sezan explains:

“As will be appreciated from the foregoing description, the hybrid deinterlace scheme of the present invention provides an effective mechanism for selecting, on a pixel-by-pixel basis, between merging and (edge-adaptive) spatial interpolation, in accordance with relative image motion at locations of the missing pixels of a deinterlaced image frame, so that the reduced complexity advantages of using merging in steady regions of the image may be maintained, yet obviates the problem of edge-based artifacts, by employing an edge-adaptive spatial interpolation method when relative motion is detected.” (Sezan, col. 9, lines 46-56) (emphasis added)

(iii) Sezan does not disclose repeating motion detection and interpolation for each block of pixels of a field.

Claim 1 recites repeating, for each block of pixels of the field, the determining of motion for each block of pixels and performing temporal or spatial interpolation for each block of pixels depending on the motion. Sezan does not disclose block-based motion detection. In Sezan, motion is detected for all pixels of a field before any interpolation is performed. In addition, Sezan does not disclose performing interpolation for a block of pixels before performing motion detection on the next block of pixels. In Sezan, merging and spatial interpolation is performed in one step after motion detection for all pixels in the field has been performed.

Thus, Sezan does not disclose any of (i) determining a motion characteristic for a block of pixels, (ii) performing interpolation on a block of pixels, or (iii) repeating the motion detection and the interpolation for each block of pixels of the field. Because Sezan does not disclose all of the elements of claim 1, reconsideration of the § 102(b) rejection and allowance of claim 1 are requested.

B. Dependent claims 2-6

Claim 2 recites “writing a motion history bit in a motion history buffer to indicate whether the block of pixels exhibits the motion characteristic” (emphasis added). The value in each location of the motion detection array M of Sezan contains the motion decision for a particular pixel. Sezan does not disclose a motion history bit indicating whether a block of pixels exhibits a motion characteristic.

Claim 6 recites, “wherein each successive block of pixels examined in steps (a) and (b) overlaps another block of pixels of the field.” Sezan does not disclose interpolating blocks of pixels. Because Sezan does not disclose block-based interpolation, Sezan also does not disclose interpolation of blocks in which the blocks overlap.

Claims 2-6 depend directly or indirectly from claim 1. In addition to the reasons explained above, dependent claims 2-6 are allowable for at least the same reasons for which claim 1 is allowable. Reconsideration of the § 102(b) rejection and allowance of claims 2-6 are requested

C. Independent claim 7

Claim 7 recites a “field of pixels comprising rows and columns of blocks of pixels . . . analyzing one of the blocks and determining whether the block exhibits a motion characteristic; and (b) using a first interpolation method to generate interline gap pixels for the block in step (a) if the block is determined in step (a) to exhibit the motion characteristic, otherwise using a second interpolation method to generate the interline gap pixels for the block” (emphasis added).

Sezan does not form the basis for a valid rejection under § 102(b) because Sezan does not disclose all of the limitations of claim 7. Specifically, Sezan does not disclose either (i) determining whether a block of the field exhibits a motion characteristic, or (ii) using a first or second interpolation method to generate interline gap pixels for the block of the field.

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The Examiner cites various passages and figures of Sezan as disclosing the limitations of claim 7, such as “paragraphs 2, 4, 5 of column 5 and paragraph 5 of column 6 and the claimed repeating is met by column 5 line 53-column 9 line 26 (Figs. 4-7, abstract, column 1 lines 25-30, columns 5-9)” (Office Action, p. 4, lines 9-10). None of the cited passages or figures, however, discloses (i) determining whether a block of a field exhibits a motion characteristic, or (ii) using a first or second interpolation method to generate interline gap pixels for a block of a field. Sezan does not disclose these limitations for the same reasons that apply to claim 1.

Because Sezan does not disclose all of the elements of claim 7, reconsideration of the § 102(b) rejection and allowance of claim 7 are requested.

D. Dependent claims 8 and 11-12

Claim 11 recites, “performing step (a) on each of the blocks and thereby determining whether each of the plurality of blocks exhibits the motion characteristic”. Sezan does not disclose determining whether a block exhibits a motion characteristic. Sezan discloses only making a motion decision for individual pixels.

Claims 8 and 11-12 depend from claim 7. In addition to the reasons explained above, dependent claims 8 and 11-12 are allowable for at least the same reasons for which claim 7 is allowable. Reconsideration of the § 102(b) rejection and allowance of claims 8 and 11-12 are requested.

E. Independent claim 13

Claim 13 recites a “block-based motion detection and deinterlacing (BBMDD) circuitry that receives segments of blocks from the memory controller, for each segment the BBMDD circuitry analyzes each of the blocks of the segment and determines whether each such block exhibits a motion characteristic, wherein if one of the blocks is determined to exhibit the motion characteristic then the BBMDD circuitry uses a first interpolation method to

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generate interline gap pixels for the block but if the block is determined not to exhibit the motion characteristic then the BBMDD circuitry uses a second interpolation method to generate the interline gap pixels for the block" (emphasis added). Sezan does not form the basis for a valid rejection of claim 13 under § 102(b) because Sezan does not disclose either (i) circuitry that determines whether each block of pixels exhibits a motion characteristic, or (ii) circuitry that generates interline gap pixels for a block of pixels.

The Examiner states that "the claimed block-based motion detection and deinterlacing circuitry is met by the blocks 501, 502 and 503 (Fig. 7, column 5 line 15-column 9 line 26) (Figs. 4-7, abstract, column 1 lines 25-30, columns 5-9)" (Office Action, p. 4, lines 15-17). Applicants respectfully disagree.

The cited passages and figures of Sezan do not disclose the recited limitations. The applicants first note that the columns 5-9 cited by the Examiner comprise substantially the entire detailed description of Sezan and do not particularly point out a disclosure of any claim limitation. The blocks 501-503 of Sezan represent steps of the method of figure 7 and do not disclose the recited circuitry. Figure 4-6 do not disclose circuitry. Moreover, figures 4-7 do not even disclose a method for determining whether each block of a field exhibits a motion characteristic. The Examiner even points to the abstract as disclosing the recited limitations. But the abstract also makes clear that Sezan does not perform block-based motion detection. The abstract explains that motion detection is performed for each missing pixel:

"A hybrid deinterlace mechanism employs motion detection as a precursor to select the value for each missing pixel of a deinterlaced frame. If the missing pixel is found to belong to a steady or non-motion portion of the image, then its value is replaced by the corresponding value in the adjacent field (i.e., merging is performed). Otherwise, (where image motion is present) spatial interpolation, preferably edge-adaptive interpolation, is employed to determine the value of the missing pixel." (Sezan, Abstract) (emphasis added)

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None of the passages of Sezan cited by the Examiner discloses either (i) circuitry that determines whether a block of pixels exhibits a motion characteristic, or (ii) circuitry that generates interline gap pixels for a block of pixels.

Because Sezan does not disclose all of the elements of claim 13, reconsideration of the § 102(b) rejection and allowance of claim 13 are requested.

F. Dependent claims 16-21

Claim 17 recites, "wherein the BBMDD writes a motion history bit into the motion history buffer for each block of pixels to indicate whether the block of pixels exhibits the motion characteristic" (emphasis added). The value in each location of the motion detection array M of Sezan contains the motion decision for a particular pixel. Sezan does not disclose a motion history bit indicating whether a block of pixels exhibits a motion characteristic.

Claims 16-21 depend from claim 13. In addition to the reasons explained above, dependent claims 16-21 are allowable for at least the same reasons for which claim 13 is allowable. Reconsideration of the § 102(b) rejection and allowance of claims 16-21 are requested.

III. Claims 1-8, 11-13 and 16-21

Claims 1-8, 11-13 and 16-21 are also rejected as being anticipated by Sezan et al. (USP 5,521,644) (Office Action, p. 5, lines 8-10). The Examiner does not, however, present a *prima facie* case of anticipation because the Examiner does not allege that Sezan (USP 5,521,644) discloses all of the limitations of each of the rejected claims 1-8, 11-13 and 16-21. Thus, reconsideration of this anticipation rejection is requested. Sezan (USP 5,521,644) does not disclose any of (i) determining whether the a block of pixels exhibits a motion characteristic, (ii) performing temporal interpolation for the block if the block of pixels does not exhibit motion, (iii) performing spatial interpolation for the block if the block of pixels exhibits motion, or (iv) repeating

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the temporal interpolation and the spatial interpolation for each of the blocks of pixels of the field

IV. Conclusion

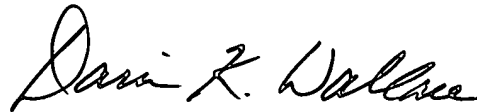
In view of the foregoing amendments and remarks, Applicants respectfully submit that the entire application (claims 1-21 are pending) is in condition for allowance. Applicants respectfully request that a timely Notice of Allowance be issued in this case. The undersigned can be contacted at (925) 550-5067 to discuss any aspect of this application.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

By 
Darien K. Wallace

Date of Deposit: November 29, 2006

Respectfully submitted,



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